Light and Lighting

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Training in Illuminating Engineering

THERE is much ground to be made up in the reconstruction of old lighting schemes, and there must be, in the years to come, great opportunities for the design of new ones.

Consider. During the last six years there have been scarcely any new lighting developments except for national needs, in offices and factories and for essential work. All other fields—streets, stores, houses, shops, restaurants, cinemas and theatres, etc.—have accumulated needs which should now be satisfied.

There should, therefore, be plenty of work and plenty of opportunities for illuminating engineers who know their jobs.

Great interest attaches, therefore, to the Training Scheme which the I.E.S. is initiating (see pp. 92-94). It will take a little time to get this going. The first step is to get courses in illuminating engineering started at various centres, and this cannot be done without some knowledge of the demand.

Will those interested, therefore, study these pages and, if they are disposed to get in on the ground floor, return the forms at once?

New Lamps for Old

We are all anxiously awaiting the new types of Fluorescent Lamps of smaller size and wattage, to supplement the familiar 5 ft. 80 watt so widely used in industry.

An encouraging announcement from the E.L.M.A. assures us that the lamps are coming. Meantime it is good to have the data, for use in planning the lighting of the future. Who can doubt that fluorescent lighting, when fully developed, will revolutionise existing methods, giving rise not only to new standards but to new technique? A word of warning, however. Even in America, the land of plenty, there has been some criticism of these new wonders. But we suspect it is the old story—occasional misuse of the benefits that science has provided. There is nothing so good that it may not do harm if unwisely used.

A.P.L.E. Conference

We learn that arrangements are proceeding smoothly for the conference of the Association of Public Lighting Engineers, to take place in Glasgow during September 11-13. An interesting series of papers is in preparation and we note from *Public Lighting* that nearly thirty firms have arranged to be represented in the exhibition of street lighting fittings to be organised in the premises of the Corporation Lighting Department. Visitors will be welcomed by the Lord Provost of Glasgow and a Civic reception will be held in the City Hall on the opening evening. It is pointed out that this is really the postponed conference of 1939 when many interesting developments were pending. The present conference affords an opportunity to take up the threads again.

Presentation to Mr. R. Pye

Mr. R. Pye, whose appointment as secretary of the Illuminating Engineering Society was recently announced, entered upon his duties on July 1.

Before leaving Leeds for this purpose Mr. Pye was presented by his colleagues with the B.T.H. with book tokens to the value of £6.

The new honorary secretary of the Leeds Centre is Mr. E. Smith (28, St. Paul's-street, Leeds 1) to whom any enquiries in regard to the work of the Centre should now be addressed.

The Future of Public Lighting

With the termination of double summer time on July 15 authority was given for normal street lighting to be reintroduced. We have since benefited by this removal of restrictions, and many streets have reverted almost to their pre-war night appearance. It is well to make this qualification, firstly because, even now, much of the available street lighting does not come up to full pre-war standards, and secondly, because much of the supplementary illumination in the form of illuminated signs and shop-windows and luminous signs, etc., is still forbidden. It is greatly to be desired that before the Christmas season arrives these restrictions will be removed, that streets will completely resume their cheerful appearance by night and that shop windows will have not only good lighting but something in their windows well worthy of illumination. All these fields of lighting, even when legislative limitations have been completely removed, will still be subject to technical difficulties, not the least of which is shortage of lighting equipment. But in the background, is another problem based on administration—the expediency of some form of central control and of means to secure better uniformity. This problem was fully recognised in the M.O.T. Department Report, issued in 1937, in which many useful concrete suggestions were made. But what follows? In discussing this subject *Public Lighting* recalls a recent question addressed in the House of Commons to the Parliamentary Secretary of the Ministry of War Transport asking "whether he intended all roads in the post-war years to have standard and uniform lighting, and would he see that a typical specification was issued to ensure this result?" Mr. Noel Baker, in reply, recalled that the Ministry "has no power to require highways authorities to light main roads," though he hoped that the standards proposed in the M.O.T. report would be generally adopted after the war by competent lighting authorities. There the matter stands. In the meantime it is evident that, even within the boundaries of London, great lack of uniformity exists. Even though it may be conceded that in general local control of public lighting is best left in the hands of public authorities, there is no doubt that a central authority such as the Ministry of Transport, furnished with adequate powers and aided by expert advice, could do a great deal to help public authorities and to bring about improvement in present conditions. We hope that they will be encouraged to do so. Recent discussions have naturally related mainly to street lighting regarded from a utility standpoint, but in the lighting of cities and their environs "lighting for amenity" should surely not be overlooked. There is much that can be done to enable better use to be made of our parks and open spaces by night, to show up the main features of buildings of architectural distinction and historic importance—to evolve, in short, some of the pleasant conditions which were pictured in 1931 when the International Illumination Commission met in this country.

I.E.S. Lighting Reconstruction Pamphlets

As is mentioned in a notice on another page (page 101), some copies of the Lighting Reconstruction Pamphlets are still available. These pamphlets are perhaps not so well known as they deserve to be amongst I.E.S. members, and it was an enterprising step on the part of the Newcastle Centre, early in the present year, to arrange for an address by Mr. H. V. Field, reviewing the contents of the first three. This Mr. Field did very conscientiously, giving a complete account of the precepts involved, and dealing with the lighting of schools very fully. The author subsequently made some comments, some favourable but others critical and therefore interesting in view of the generally favourable reception which the pamphlets have received One gathers that Mr. Field would have preferred a single comprehensive treatise, on the lines of the familiar D.S.I.R. Report (Post War Building Studies No. 12). Here, one suspects, the idea behind these pamphlets has been somewhat misunderstood. The intention was not so much to produce a textbook, but rather something readable, which could be used in approaching different sections of the community in turn—a method which naturally involved some degree of repetition. Some doubt was also expressed whether the pamphlets would meet with much demand. Experience of the complete list of pamphlets (now six in number) seems to show that this was rather a pessimistic prediction. We understand that most of the pamphlets have been reprinted, in some cases more than once, and that in all over 15,000 have been sold—not a bad result in view of the limited publicity resources available. It will be recalled also, from the statement in the Annual Report of the Council, that practically all the original cost of production has been recovered from sales.

Road Illumination: The Problem of Dazzle

It may interest readers to know that the excellent joint meeting arranged between the I.E.S. Birmingham Centre and the Institution of Automobile Engineers in February last has now been published. The account is interesting for the report of the discussion in which a number of good points were made. Mr. Lund approved the idea of three distinct systems of lighting for cars of different types. He seemed to condemn the dipping headlight, in this respect going rather beyond what Dr. Nelson would sanction. Mr. T. J. Sack, commenting on the American "sealed beam" system, thought that the expense of "practically throwing away the headlamps every time the filament failed." was more than the British public would stand. Mr. John Howell voiced an admitted grievance when he protested against it being left to the discretion of a constable to say whether a lamp was glaring or no. Mr. Waldram, in his reply, endorsed the need for greater uniformity in street lighting and denounced the so-called kerb lighting (certain to crop up in a discussion of this kind!) for the sound reason that it would not work.

(*By the courtesy of the Institution of Automobile Engineers there is now available a stock of copies of the published account of this meeting. I.E.S. members interested can obtain a copy on application to the Secretary of the Society.*)

Fluorescent Lamps

Past Experience and Future Prospects

(Summary of a Statement issued by the Electric Lamp Manufacturers' Association.)

A circular issued by the Electric Lamp Manufacturers' Association reviews experience with fluorescent lamps since their introduction shortly before the war and their future applications.

It is recalled that, following the outbreak of war, E.L.M.A. manufacturers recognising the urgent need for better industrial lighting, placed the whole of their fluorescent lamp research and production facilities at the disposal of the Government. Following this the Government set up a special organisation for dealing with industrial lighting and co-operated with the electrical industry in ensuring the most effective and economical use of fluorescent lighting. It was decided that the new lamps should be used only for essential war purposes and that the only size to be manufactured should be the 5-ft. 80-watt lamp, because it was the easiest to produce in large numbers and also the most efficient unit for industrial lighting.

The story of the fluorescent lamp in this country is thus essentially a part of the history of the world war. Its importance in the field of munitions production was very great; indeed, the upgrading of factory lighting to the requisite standard could scarcely have been achieved without it. It was not only a question of the improved quality of fluorescent lighting and its beneficial effect on the well-being of the workers. It was also true that only by the use of fluorescent lamps could the desired quantitative increase in lighting be achieved without a disastrous rise in peak demand—and in consequence larger cables and other transmission equipment.

Now, however, we have to plan for the future. During the next few years the fluorescent lamp will revolutionise both lighting standards and lighting methods in every field of illumination. Evidently, too, the single size which satisfied the needs of wartime will by no means suffice for the thousand and one decorative and utilitarian requirements of peacetime lighting.

Whilst it is anticipated that the 5-ft. 80-watt lamp will continue to be the most suitable for industry in general, there will be many applications of a commercial or domestic nature where the smaller lamps, used singly or in groups, will be better suited to the purpose. This applies particularly to shop windows and showcases, and to homes where fluorescent lighting will help to produce ideal future conditions.

Many wartime limitations in materials, machinery, and labour still remain. Hence, although a variety of new lamps have been developed and produced experimentally, E.L.M.A. members are not yet in a position to make any definite statement on marketing dates and prices.

They are, however, pleased to state that the future fluorescent range will include the following:—

Length. (Feet.)	Diameter. (Inches.)	Voltage.	Nominal Watts.
4	1½	200/250	40
3	1	200/250	30
2*	1½	100/130	20
2	1	200/250	20
1½*	1	100/130	15

* These lamps operate two in series (i.e., two 20-watt or two 15-watt) on 200/250-volt A.C. mains, or singly on 100/130-volt mains.

All the above lamps will be fitted with Bi-Pin caps of American type, and will be interchangeable with their American counterparts—a fact of the utmost importance in connection with export business; 80-watt lamps will continue to have B.C. caps for the present, but they, too, will be made with Bi-Pin caps in due course.

All the above lamps will be available both in "daylight" tint and also in the "warm white" introduced in December last as an alternative colour, more acceptable for many non-industrial purposes.

Training in Illuminating Engineering

Proposed I.E.S. Scheme

During recent years there have been outstanding developments in sources of light and in methods of light control, and the knowledge, both theoretical and practical, required from an efficient illuminating engineer has greatly increased.

The Illuminating Engineering Society therefore recognises that the time is ripe for the introduction of a scheme of education for illuminating engineers, with which will ultimately be incorporated some system affording a hallmark of professional competence.

The requirements of such a scheme are *firstly* a general educational background, *secondly* a theoretical knowledge of the elements of illuminating engineering, and *lastly* a period of experience in the practice of illumination.

The educational background should include a fair knowledge of such subjects as mathematics, physics (heat, light and sound), English and mechanical drawing, up to the standard of the Joint Section "A" examination of the Institutions of Civil and Electrical Engineers*, or its equivalent in other allied fields.

The minimum standard of theoretical knowledge in the field of illuminating engineering is that required for passing the Intermediate Grade of the Examination in Illuminating Engineering of the City and Guilds of London Institute.*

Fuller details of the complete scheme will be issued in due course. In the meantime the I.E.S. Council is initiating facilities for obtaining the necessary technical education. Appropriate classes for the Joint Section "A" examination, which is of wide application, are likely to be available at most universities and technical colleges. The provision of classes in illuminating engineering must, however, depend on sufficient support being forthcoming to justify them. Provided there is sufficient demand courses could be arranged in London, Birmingham, Edinburgh, Glasgow, Leeds, Manchester, Nottingham and probably other cities.

A typical course would call for attendance for 2½ hours one night per week for one full session. Students whose standard of general education is not up to that required for the Joint Section "A" examination would be well advised to devote at least one further night per week to classes appropriate to that examination. Those whose knowledge is not yet up to School Certificate (Matriculation) standard should concentrate on improving their

* Full particulars of these respective examinations may be obtained on application to the Secretary of the Institution of Electrical Engineers, Savoy-place, Victoria Embankment, London, W.C.2, and to the Superintendent of the Department of Technology, City and Guild of London Institute, 31, Brechin-place, London, S.W.7.

general knowledge before commencing specialised classes in illuminating engineering.

In order that some indication may be available as to the existing demand for education on the lines indicated above, readers interested therein are requested to fill up and return the attached form to the Secretary of the Illuminating Engineering Society. (See Form No. 1.)

It is thought that many organisations employing illuminating engineers will also wish to take advantage of the classes in illuminating engineering, especially in the case of men who are returning from the Forces or whose work is being converted from a war to a peace basis. Even in the case of young men who are still awaiting a call up into the Forces, and who may therefore be better advised to defer the course in illuminating engineering until their return, classes enabling them to qualify for the Joint Section "A" examination might be taken with great advantage.

All organisations interested in the above scheme are requested to communicate with the I.E.S. secretary advising him of the number of likely candidates, the date on which they would be prepared to commence study, and the centre which would be most convenient for them. (See Form No. 2.)

FORM No. 1. ***For the Use of those Proposing to Take Courses.***

Training in Illuminating Engineering

This form to be returned to the Secretary of the Illuminating Engineering Society, 32, Victoria-street, London, S.W.1.

I wish to enter for a Course in Illuminating Engineering in the neighbourhood of .....

I also wish to take supplementary courses in the following subjects:—

.....

.....

Signature .....

Please write clearly and in BLOCK LETTERS

Name and Address .....

.....

Date ....

FORM No. 2. ***For the Use of Firms and Organisations.***

Training in Illuminating Engineering

This form to be returned to the Secretary of the Illuminating Engineering Society, 32, Victoria-street, London, S.W.1.

I append the following particulars of members of our staff for whom Courses in Illuminating Engineering are desired:—

.....

.....

(Names and addresses of intended students, and particulars of the most convenient locality for courses should be given. If necessary the further particulars may be given on an attached sheet of paper.)

Signature .....

Please write clearly and in BLOCK LETTERS

Title and Address of Firm or Organisation .....

.....

Date ....

Resettlement Education

The Society has also been in contact with the Ministry of Labour with regard to the educational schemes for men while still in the Forces, or immediately after leaving them. In each case, if the demand is forthcoming, provision can be made for the inclusion of illuminating engineering subjects. For those still in the Forces the education would be on general "broad interest" lines, but on demobilisation the schemes would provide for more strictly vocational training, probably in the form of concentrated full-time education over a short period.

It is felt that many organisations may be holding jobs for junior pre-war staff, who would, under ordinary circumstances, have qualified as illuminating engineers, or for whom qualification in this field would offer improved prospects of satisfactory employment, and that for such people the provision of illuminating engineering courses would be of practical assistance.

Here, again, however, it is a question of supply and demand, and the Society has been asked by the Ministry of Labour to ascertain to what extent such courses would be patronised.

Any firms or organisations interested in this scheme, either for pre-war staff returning to them, or on behalf of new staff for whom they expect to find openings, are also requested to write to the I.E.S. Secretary, giving full particulars. If such courses are arranged, it is particularly hoped that all I.E.S. Sustaining Members will encourage members of their illuminating engineering staff still in the Forces to take advantage of them.

Is There Anything Wrong With Fluorescent Lighting?

(Communicated.)

In commenting on the recent discussion of this topic in "Illuminating Engineering" (May, 1945), we prefer to give the title a question mark because, up to the present time, discussion in regard to cause and effect has been very speculative. Since the system has been used continuously by many thousands of workers in this country, with satisfaction and no discomfort, during the war it is difficult to believe that there can be anything intrinsically very wrong with it. On the other hand, there have been occasional cases of people who complained of eye trouble after working under the light of fluorescent lamps for some time. These cases have led to some inquiry, but apparently without any very definite causes being discovered —apart from instances of manifest misuse of the lamps, to which reference will be made later.

Experience in U.S.A.

In the United States, however, complaint seems to have been made on a more generous scale.

In his recent contribution (loc. cit.) Mr. L. D. Morgan refers to experience in the Pacific North-West, where "ophthalmologists and optometrists report that probably 20 to 33 1-3 per cent. of patients say that they first noticed eye-strain when they started working under fluorescent lighting." Mr. Morgan also recalled similar complaints recorded in the South-West by Dr. E. B. Ley (Illum. Engg., Sept., 1944), who remarked on:—

(1) The use of fluorescent office lighting furnishing 33 foot-candles.

(2) The presence of lamps with a 30 deg. angle of vision.

(3) Complaints by 90 per cent. of employees of eye fatigue, mild photophobia, headache, etc.

Possible Sources of Eye Trouble

Application was made by Mr. L. D. Morgan to LeGrand M. Hardy, Director of the Knapp Memorial Laboratories of Physiological Optics in New York City, who mentions six possible causes of unpleasant effects, namely: (1) Flicker ("total" or "electrode"), (2) Spectral Quality, (3) High Brightness, (4) Radiation at wavelength 313 mμ, (5) Lag of Emission in blue-green-yellow, and (6) Stroboscopic effects.

It is explained that "total flicker" is usually due to under-voltage or deteriorated lamps, but "electrode flicker" is frequently seen when these two factors are apparently normal. It is remarked that the radiation from the strong double line at 312 mμ, is under suspicion, but little is known in regard to effect; the same, apparently, applies to items (2) and (5). LeGrand Hardy, however, seemed to attach most importance to the "high intrinsic brightness," 5.5 candles per square inch in the 40-watt daylight tube, which he suggests should be reduced below 2, preferably 1 candle per square inch.

In the subsequent portions of his paper Mr. L. D. Morgan discusses in turn possible effects of ultra-violet radiation and recalls various statements on glare, for example, dictum of Nutting that doubling the level of illumination permits an increase in brightness of courses of about 20 per cent. He also quotes Dr. Luckiesh's conclusion that there is no appreciable difference in "seeing" under light from fluorescent and tungsten lamps—though he rather doubts the validity of this test, which was based on "blinking."

In commenting on this discussion Dr. M. Luckiesh expressed the view that glare from large installations of bare fluorescent lamps in the visual field is the probable cause of many complaints. In no case has an eye specialist proved that the cause of any alleged or actual deleterious effect upon the eyes has been due to any peculiar spectral characteristics of fluorescent light. All statements

in regard to the effects of u.v. radiation from the fluorescent lamp apply equally well to this part of the spectrum of sunlight or sky light. No valid conclusions can be drawn without *quantitative* data in regard to dosage. This point was likewise emphasised by LeGrand Hardy, who thought it almost impossible that any ordinarily used illuminant could cause any abiotic reaction. He was equally sceptical in regard to the aribo-flavinosis (Vitamin B deficiency) hypothesis discussed by Mr. Morgan.

Glare the Chief Factor

From these and other discussions it seems fairly clear that there is no valid evidence on which to assume any obscure prejudicial effect on the eyes due to the peculiar nature of the spectrum of radiation from fluorescent lamps. Those with long memories will recall similar speculations when any new illuminant appeared; for example the apprehension —quite unjustified—of the effect of u.v. rays from metal filament lamps, which even led to the making abroad of bulbs of yellow-tinted glass designed to absorb such radiation.

One may infer that the two factors most likely to cause eye trouble are flicker, usually due to imperfections in service conditions, and glare, usually due to misuse of the new lamps. There seems no evidence that the ordinary cyclical variation in the light causes any inconvenience, being in fact inappreciable to the eye at standard frequencies. The resultant stroboscopic effect on moving objects may sometimes prove a drawback, but can usually be minimised by putting lamps on alternate phases or similar devices. Flicker due to imperfect operation of lamps is presumable an occasional defect not inherent in the lamps, which will doubtless be completely eliminated as methods improve.

Misuse of Lamps

It is surely odd that the question of glare should now arise in connection with an illuminant whose low brightness is comparable with that of the candle flame or the white sky. The explanation is to be found in this very circumstance which has led to the abuse of the lamp's good qualities. Before the era of the fluorescent lamp it was not unusual for objection to be raised to the proposed limitation of brightness of fittings to five candles per square inch, on the ground that it was difficult to accomplish and unnecessary. Now, when we have available a lamp with a brightness of this order, there is a demand for an even lower limit. LeGrand Hardy, quoted above, suggests that brightness should be reduced below two, and preferably to one candle per square inch, at least for fittings within the normal range of vision.

Elsewhere in the same issue of "Illuminating Engineering," Mr. J. L. Kilpatrick deals with the same point. He recognises that bare fluorescent lamps have their uses, even when in the line of view, if intended for purposes of display, and in order to make an appeal to the eye and attract attention. But for sustained use *for seeing* in offices, schools, etc., and in home lighting, this condition should not be tolerated. He suggests narrow shielding devices to tone down the brightness.

A point that needs to be realised is that although the brightness of the fluorescent tube is low there is a considerable expanse of this brightness. It is not surprising, therefore, if the eye is troubled by its near presence, at distances of only a few feet. It is these local or semi-local applications of the lamp that seem most likely to give rise to complaints of eye trouble, especially if experienced for prolonged periods. It would seem that for local lighting the source of light should always be completely screened from view—except possibly when, by the use of plastics or other materials it can be reduced to a very low order indeed, perhaps 0.1 or even 0.01 candles per square inch.

Mounting at Ceiling Level

Even in the case of comparatively distant lamps, the display of a large number against a fairly dark background, as is not unusual in stores, is not quite happy. The writer has long held the belief that the fluorescent lamp is most effective when mounted direct on the ceiling, preferably at the junction of wall and ceiling. In such circumstances no screen or reflector is necessary. The tube is out of the direct range of view, and even when it does catch the eye, is inconspicuous against the light illuminated background. In such circumstances the blending with daylight may be so successful that inmates of the room may quite fail to notice when artificial light has replaced natural lighting. An excellent example is to be seen in the Committee Room at the E.L.M.A. offices in Bedford-square (London).

The Thomas Young Oration

Delivered by Professor Ragnar Granit before the Physical Society on June 29th.

The 14th Thomas Young Oration to the Physical Society was delivered on June 29 by Professor Ragnar Granit, of the Nobel Institute for Neurophysiology, Stockholm, his subject being "The Electrophysiological Analysis of the Fundamental Problem of Colour Vision." Professor Granit pointed out that the generation of electric pulses in the optic nerve by light incident on the retina had long been studied. In recent years two advances in technique had greatly increased our knowledge of the electrical response of the retinae of experimental animals, rabbits, frogs, rats, etc. Hartline's method of repeated dissection enabled single fibres of the optic nerve to be isolated and their individual responses measured. In the micro-electrode technique, developed by Granit, on the other hand, the response of a single fibre in the nerve plexus lining the retina was obtained by applying the point of a fine wire to the retina of an eye from which the lens and cornea had been removed, the other electrode being placed on a moist pad at the back of the eye. The single fibres studied in this way were believed to be connected to single end-organs (rods or cones) or to groups of a few such organs. From the minimum intensity of light of different wave-lengths required to produce electric pulses, an electro-physiological spectral sensitivity curve for the single fibre could be determined. In retinae containing rods, a sensitivity curve resembling that of the dark-adapted human eye was obtained predominantly, but under suitably contrived light adaptation conditions a wide variety of curves peaking at different parts of the visible spectrum could be recorded. These could be classed as relatively broad, "dominator" curves and relatively narrow "modulator" curves. Professor Granit explained how analysis of the results led to the view that the dominator curves were produced by groups of end-organs possessing different modulator curves and, finally, that the three response curves derived from experiments on human colour vision were also composite and made up from the modulator curves of a number of end-organs. The lecturer touched on several other aspects of colour vision which must be passed over in this brief resport.

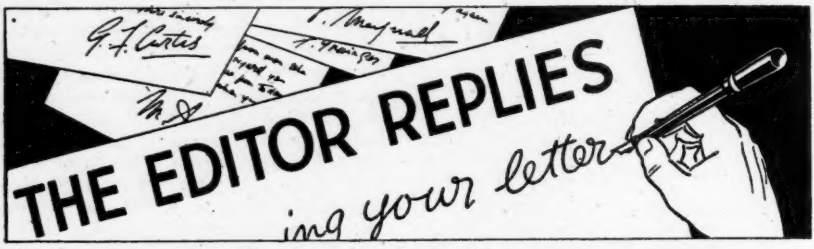
Moving the vote of thanks, Sir John Parsons (Thomas Young Orator in 1931) remarked that Professor Granit's brilliant researches lay in a field in which the earliest careful measurements had been made in this country by Gotch some 40 years ago.

American I.E.S.: New President

It is announced that Mr. Albert F. Wakefield, president of the F. W. Wakefield Brass Company (Ohio), has been elected president of the Illuminating Engineering Society (U.S.A.), and will take office on October 1. Mr. Wakefield's firm is concerned with the manufacture of lighting and signalling equipment for the Navy, and he himself is well known in marine circles, having been concerned with yacht racing for 27 years. He has been an active member of the Society for over 25 years, and served on numerous committees prior to his election as vice-president in 1943.

Erratum

In our last issue (page 75) a summary was given of the interesting address on Aerial Reconnaissance, recently delivered by Mr. F. Darlington. We regret, however, that by a clerical error this event was attributed to the I.E.S. Bradford Group. Mr. E. Wood, the secretary of the Huddersfield Group, reminds us that Mr. Darlington's address was delivered to their members.



With reference to the remarks on the need for relatively **high daylight factors** in our last issue (p. 84) and in particular their bearing on the design of schools, I have been asked what definite evidence is available that **indifferent lighting**, either natural or artificial, results in **damage to eyesight.**

This is a difficult question to answer. I recall that when the Departmental Committee on Lighting in Factories and Workshops first commenced their investigation a circular letter was addressed to leading oculists on this subject, but without eliciting any definite evidence. The belief that unsatisfactory lighting must react unfavourably on the eyes, as well as causing fatigue and general strain, is doubtless well founded. But it is most difficult, where so many factors are involved, to trace relations between cause and effect.

It has been remarked that the recently issued D.S.I.R. report on Post-War Lighting of Buildings does not present very strong evidence on this point. The problem of **the eyesight of school children** naturally attracted the attention of illuminating engineers at an early date. A "Special Section" in the very first issue of *The Illuminating Engineer* (Jan., 1908), contains about a dozen pages devoted to this topic. Data from British, Continental and American sources were quoted.

All tell the same tale—the progressive deterioration in the eyesight of children during the period of school life. The explanation is possibly complex. Malnutrition, inherited weakness, and undue subjection of the eyes to close work have been suggested. Amongst these various factors it is difficult to separate out the effect of poor lighting, though, as stated above, one can hardly doubt that this, by increasing strain and effort, does play an essential part. The dominant consideration, it has always seemed to me, is that this **deterioration in vision** of the growing child takes place over a period when **all other powers are developing normally and improving.** There must surely be something in our mode of life to account for this anomaly. In the meantime the least we can do is to render our schools, so far as is possible, free from reproach in regard to structure, design, and equipment.

Planning of future lighting in general terms, i.e., values of illumination, absence of glare, and general principles may well be done now in spite of limitations imposed by present conditions. So far as electric lighting is concerned, however, there is a sense of unreality in detailed planning, for the **technique of the future** must be fundamentally affected by the nature of **the new lamps**, especially fluorescent lamps, likely to be available.

Of great interest in this connection is the announcement (see p. 91) by the E.L.M.A., of **a forthcoming range of fluorescent lamps** varying in length from 1½ ft. to 4 ft., and consuming 15 to

40 nominal watts. These lamps are to be available in both "daylight" and "warm white" tints.

When recently meeting Mr. Ewart Hugh, an illuminating engineer prominently connected with the **American lighting industry,** I was struck by **the variety of fluorescent units,** ranging in consumption from 14 to 100 watts, with a corresponding gradation in length from 15 in. to 60 in., now in use in the U.S.A. Further types of higher wattage appear to be in prospect. These types are available in "white," "daylight," and "soft white."

In reviewing the future some time ago I hazarded the opinion that, for some time to come—partly owing to limitations in the production of fluorescent lamps—the bulk of electric lighting will continue to be done with filaments. In America, however, there are some who believe that **ultimately lighting will be done almost exclusively with fluorescent lamps** of various shades and sizes—filament lamps becoming obsolete except for special fields in which control of light from a small source is desirable, e.g., for projection, spotlights, and to a great extent in street lighting.

I was interested to hear from Mr. Hugh that variety is now entering into the shapes of fluorescent lamps. Some objection has been taken to the familiar 5 ft. tube from the aesthetic standpoint, and it is also said to be liable to give rise to troublesome shadows in drawing offices. One notes with interest, therefore, the announcement of **ring-shaped lamps,** in three sizes, one fitting into another in the U.S.A.

Our remarks in the June issue (page 76) on lighting on the Underground railways have occasioned a reminder of one enterprising development, **the lighting of a coach with fluorescent tubular lamps,** similar to those used in factories but of somewhat smaller length. It seems quite likely that this form of lighting will come into general use for lighting railway coaches, especially as it promises an economy in running expenditure. We may also look forward to the use of fluorescent tubular lamps, possibly in colours, for **the lighting of station platforms.** A few experiments were made in this direction shortly before the outbreak of war.

Mr. R. Maxted: Appointment in Germany

Although Mr. R. Maxted has kept in good contact with the I.E.S., to which he has continued to render good service (as illustrated in the paper contributed jointly with J. N. Hull on April 18). He has in fact been responsible for a Group of Sections under the Ministry of Supply since 1943. During the subsequent two years he has done much special work on searchlights and other devices, which involved co-ordination of vision, optics, radiation, and electrical and mechanical engineering—besides keeping contact with his former work with the B.T.H. at Rugby. He has now taken up a new appointment as Deputy Controller of Planning and Intelligence in the Electrical Industries Branch of the Economics Division, under the Allied Control Commission for Germany. All I.E.S. Members will join us in wishing Mr. Maxted success in his new work—with the hope, however, that in course of time he will be amongst us again.

REVIEWS OF BOOKS AND PUBLICATIONS RECEIVED

The Measurement of Colour. By W. D. Wright, A.R.C.S., D.Sc. (Adam Hilger, Ltd., London. Pp. 223; figs. 65. Price 30s. net.)

There has been for some time a need for a book reviewing recent work on the Measurement of Colour. This need, having first dealt with elementary principles, Dr. Wright seeks to supply. The first chapter deals with radiation in the visible spectrum and the second with its reception by the eye. These two chapters may be regarded as introductory. The author discusses the nature of light, its reflection and absorption, and the measurement of energy distribution. He then reviews the structure of the eye and its response to light and colour, devoting some space to defective colour vision. To many people it may come as a surprise to learn that—setting apart minor variations in colour vision—at least 8 per cent. of males possess more or less grossly defective colour vision. Tests of colour blindness (some of which the author describes) are therefore of obvious importance in many fields of work, e.g., on the railways and in the Merchant Marine, the Navy, the Air Force, etc.

In Chapter III. we come to the trichromatic system of colour measurement, which the author illustrated by means of formulae and diagrams, and the C.I.E. system of colour specification. Chapters IV. and V., dealing respectively with colorimeters and spectrophotometry, are of special interest, including such up-to-date developments as photoelectric tricolorimeters and approximate methods of spectrophotometry, which, whilst less complex, may be accurate enough for many purposes. Chapter VI. deals with the Colour Atlas, of which various patterns and developments, including the Munsell system, are described.

The final chapter, dealing with practical applications, is amongst the most interesting. The author is able to point to quite a variety of industries in which colour analysis plays a part. From the illuminating engineer's standpoint, the whole subject gains in importance because of recent developments in sources of light—the range of colour available by the use of luminescent gases and fluorescent powders being very wide indeed.

The book is agreeably printed and illustrated, diagrams in colour being occasionally introduced with good effect.

A Guide to Heating, Ventilation, and Lighting. By W. Douglas Seymour. (Oxford University Press, 1944. Pp. 90. Price 6s. net.)

In the introduction to this work the author mentions that the book was planned in 1939, and he disarms criticism by describing the "blitz" conditions during the winter of 1940-41, under which much of it was written.

Certainly the bringing together of heating, ventilation, and lighting within a compact volume is a useful service. Section I. deals with Heating and Ventilation, Section II. with Lighting, and Section III. with prospects after the war. It is perhaps an apparent omission, which might be made good in a future edition, that the author does not deal in any detail with the inter-relation of matters in the first two sections—which in practice often present a pretty problem, for example, in the design of school buildings.

In his treatment of lighting the author follows familiar ground, dealing first with light in general and its relation to

seeing, and then in succession with natural and artificial lighting. Daylight factors and their prediction are briefly discussed and factors determining access of daylight summarised. In dealing with artificial lighting, tables of values of illumination are quoted, the design of lighting installations by the aid of co-efficients of utilisation is outlined, and a brief review of recent developments in lighting is given. (The fluorescent lamp, though mentioned in Section III., seems to have been overlooked here.)

The book should serve as a useful introduction to the subject. The treatment is somewhat sketchy in parts, and one notices a few omissions and anomalies. Why, for example, should *ranges* of illumination values be given for the home and *single values* for other purposes on page 66—where the I.E.S. Code might surely be mentioned—and why are such requirements as absence of glare, good shadow conditions, etc., not emphasised?

The Standards Review. (*Issued quarterly by the British Standards Institution, 28, Victoria-street, London, S.W.1.*)

A new technical publication is always an event in present circumstances. One welcomes, therefore, the appearance of the first issue of the *Standards Review* (1945, No. 1), which is to appear quarterly.

The present number covers a wide range of topics. A message from the president of the British Standards Association (the Right Hon. Lord Woolton) is followed by notes on standardisation in the fields of colour, automobiles, agriculture, screw threads, concrete railway sleepers, boiler water treatment, etc., and there are sidelights on many interesting and unusual gadgets. Amongst these is the simple electric fence, which, with the aid of a 6 v. battery, will give cattle a mild but in no sense dangerous shock on contact and keep them behind the lines. Some of the notes have pleasing illustrations, such as those dealing with copper and copper alloys, and with the British standard concert pitch which, in 1939, replaced the other various pitches of the past, some inconvenient and all difficult to maintain with accuracy.

The "Standards Review" is sent free to all subscribing members of the B.S.I. Members can also obtain additional copies at the rate of 1s. each, whilst for non-members the rate is 2s. a copy or 7s. per annum.

Lighting Reconstruction Pamphlets

Readers are reminded that copies of the series of Lighting Reconstruction Pamphlets are still available on application to the Illuminating Engineering Society (32, Victoria-street, London, S.W.1).

It will be recalled that the first five of the series are all available at the same rate (single copies 1s. each, 9s. per dozen, £3 per 100). The titles are as follows: No. 1, "The Principles of Good Lighting"; No. 2, "The Lighting of Public Buildings; No. 3, "The Lighting of Schools"; No. 4, Natural Lighting; No. 5, "Public Lighting in the City and Highway."

The sixth of the series, "Making Work Lighter," which carries illustrations by Fougasse, is issued at the special flat rate of 6d. a copy.

Classrooms for Partially-Sighted Children

The need for good lighting in school classrooms has often been stressed. One common argument is that study imposes more effort on a child, to whom, for example, letters are unfamiliar, than on an adult, to whom reading has become second nature. All the more reason therefore to avoid scrupulously any lighting defect which may add to the difficulties of the task.

The same argument obviously applies more forcibly still to the case of partially-sighted children. For them the difficulties incidental to childhood are magnified. It has often been suggested that they should be segregated and given special training in specially designed classrooms.

This course is urged by Bruce K. McAllister (*I.E.S. Lighting Review*, Australia, February, 1945), who describes efforts made on their behalf in some Australian States, notably Tasmania. He illustrates one such classroom a feature of which is *spaciousness*, so that children may be free to adjust the positions of their chairs and desks to suit their needs, and teachers free to move amongst them, giving personal attention to each child. Desks must be light in construction to facilitate easy movement. Tops of desks should be light in colour to reduce brightness contrast. The room should be bright and cheerful and the natural light, preferably south light, should be carefully planned. Blinds should screen sunlight but not obscure daylight. Window area should be a minimum of 20 per cent. of floor area. Correctly designed artificial lighting, of good quality and plentiful, to augment fluctuating daylight is essential. Blackboard lighting must be planned with care in order to avoid troublesome reflections from the blackboard (or chalkboard) surface.

All these are recommendations which might well be applied to classrooms in general. If it is held that a higher value of illumination is needed for partially-sighted children it is well to bear in mind that only a substantial advance —say at least double—is likely to have any appreciable effect on seeing capacity. Perhaps the most that can be said is that all requirements for ordinary classrooms should be observed—but with special care.

Care of the partially-sighted should not end at the classroom door. Teachers are advised to visit children and their parents in their homes. Vocational guidance is necessary if the years of careful attention to eyesight are not to be wasted.

The Safety-First Congress

The Royal Society for the Prevention of Accidents deserves great credit for carrying through their Congress in London this month—the first Safety Congress held since 1939.

The Roads Safety Exhibition, on view in the London Scottish Drill Hall from June 18-29, was well patronised. The various units, over 50 in number, each illustrating a separate safety lesson and some embodying animated models, operated by the pressing of a button, were keenly studied. The Children's Corner was highly popular and the learner driver's sections one of the high lights of the show.

The papers and exhibits covered a wide ground. Naturally, after the experience of the war and the blackout, traffic safety received special attention, well illustrated in the "Safety in the Window" display urging training of children in road sense. Another item was safety in the home—where at present accidents are more frequent than might be imagined and are liable to be accentuated by the present shortage of many essential things, such as bedsteads and fireguards.

Price Reductions in Electric Lamps

As we go to press we receive copies of illustrated leaflets issued by Metropolitan-Vickers Electrical Company, Ltd., and Siemens Electric Lamps and Supplies, Ltd., featuring various forms of service and special lamps and drawing attention to the revised prices—which, it is to be noted, have been revised in a *downward direction*.

This general reduction in the price of filament lamps is very welcome, coming as it does at a time when the price of so many things is still on the "up and up."